

Sterilization of Surfaces by Fluorine Gas.

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Gaseous fluorine can be used as a sterilant. An aggressive sterilant was sought for a particular remote application where other chemicals and methods were impractical. Since fluorine is highly reactive, it can readily attack organic compounds. It is also reactive under temperature extremes, therefore, it was selected for evaluation. In the work presented, it was found that fluorine was effective at rapidly inactivating bacterial spores and that total surface sterility could be achieved. Exposure to fluorine took place in a specially constructed chamber with a leak tight piping system. Spore suspensions of *Bacillus subtilis* ATCC 6633, *B. stearothermophilus* ATCC 10149, and *B. pumilus* (an environmental isolate) containing at least 10^6 viable spores were dispensed into small platinum trays and dried overnight at 50 °C under N₂. The trays containing spores were challenged by 100% fluorine gas for times ranging from 5 minutes to 24 hours, at 20 psig and 25 °C. The effectiveness of the process was evaluated by re-suspending and diluting the spores, and counting colony forming units in Tryptic Soy Agar pour plates. Fluorine was found to rapidly decrease the number of viable spores. Kinetic studies show a several log reduction of viability in only 10 minutes. Total inactivation could be achieved within a 60-minute exposure time. However, conditions were found that permitted spores to survive fluorine exposure. When spores were deposited from a solution of phosphate buffered saline or artificial sea-water, dried, and then challenged, significant protection was observed. The co-deposited salts from the suspending solution appeared to provide the spores some measure of protection. When spores were washed and deposited as a suspension of de-ionized water, complete sterilization was achieved.